

Tree-based Direct Sampling Code Tutorial

Chen Zuo and Zhen Yin

Department of Geological Sciences
Stanford Center for Earth Resource Forecasting



Content

1. Installation
2. Basic steps
3. Example 1: Channel simulation
4. Example 2: Antarctica topography simulation

Installation

In order to perform Tree Direct Sampling (TDS), the following software is necessary:

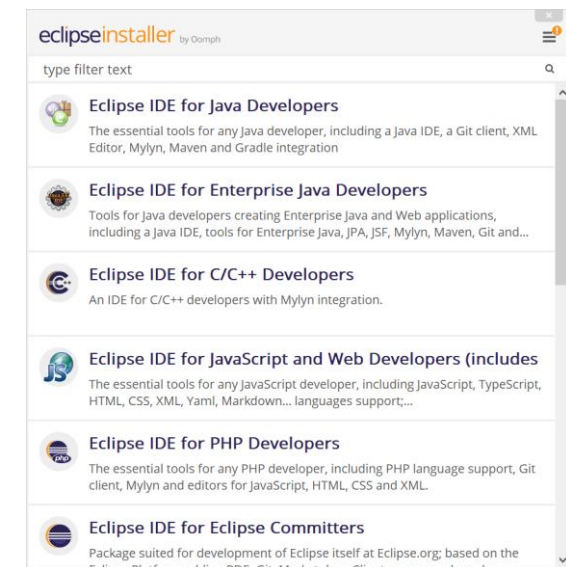
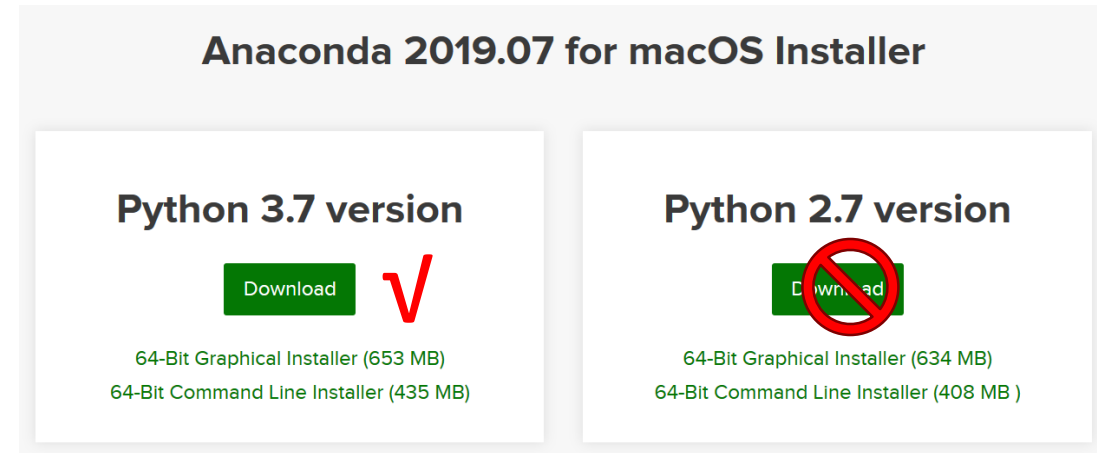
1. Anaconda and Jupyter: Python 3.7 Version

<https://www.anaconda.com/distribution/>

2. Eclipse IDE for Java developer Oracle Java SE environment

<https://www.eclipse.org/downloads/>

<https://www.oracle.com/technetwork/java/javase/downloads/index.html>



Basic Steps

1. Prepare and read the prior materials
2. Run the tree construction program
3. Paste the files created by tree construction program into the simulation folder
4. Run the simulation program
5. Output realizations
6. Evaluate realizations

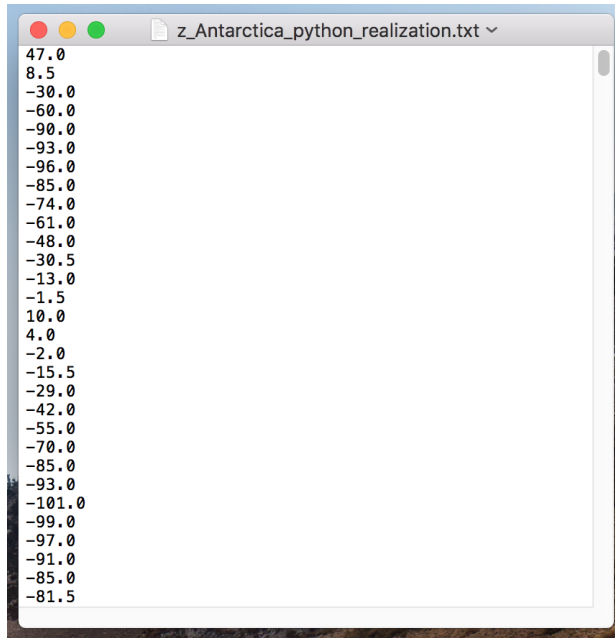
Example: Antarctica Topography Modeling (2D)

Example: Antarctica Topography Simulation

Prepare Prior Materials

Our tree-based direct sampling (TDS) can read file in bmp and txt format.

The user should compile their own reading function in the training and simulation program.



2D topography model
in txt format

In this txt file, each line stores a value at a certain pixel.

Consider the size of realization is $1,202 \times 1,202$, there are $1,202 \times 1,202 = 1,444,802$ lines in this file.

Step 1: Antarctica Topography Simulation

Tree Construction Phase

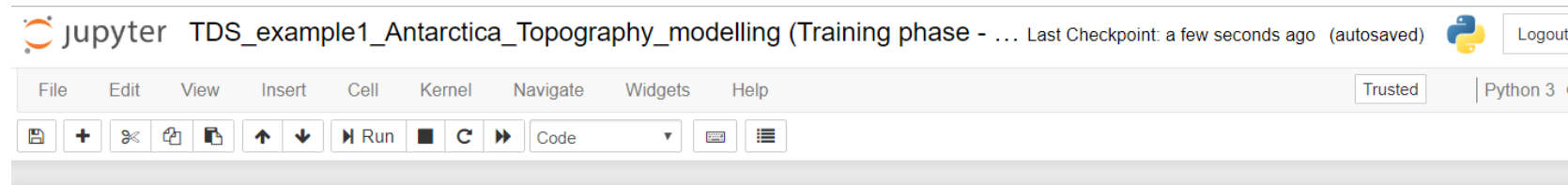
Cell Index	Workflow	Tip
1	Import necessary package	
2	Set user-defined parameters	Three parameters are required to be specified.
3	Read training image	Users can write their own function
4	Record time stamp	
5	Find the processing area	We do not concern the ocean area in this case
6	Record time stamp	
7	Extract patterns via fixed template	
8	Perform PCA to reduce dimension	The preserved variance is 80% in the example
9	Print scatter plot of patterns	Comment this cell during time recording
10	Get the reduced pattern dataset	
11	Calculate the radius within the pattern set	The radius is used to normalize the radius within clusters
12	Build the cluster tree	The core cell of training program
13	Record time stamp	
14	Output file	
15	Record time stamp	

Step 1: Antarctica Topography Simulation

Tree Construction Phase

Under directory “./Tree-based_DS/TDS_TrainingPhase”, use Jupyter Notebook to open the *.ipynb file for TI tree construction.

TDS_example_Antarctica_Topography_modelling (Training phase - build tree).ipynb



1 Tree-based Direct Sampling (TDS) on Antarctica topography modeling - Training Phase to build tree

Author: Chen Zuo and David Zhen Yin

Contact: chenzuo789@outlook.com; yinzhen@stanford.edu

Date: Aug. 22, 2019

2 Step 1. load functions

```
In [1]: # import necessary package
import matplotlib.pyplot as plt
import numpy as np
from scipy import interpolate
from src.build_TI_tree import build_TI_tree
%matplotlib inline
%config InlineBackend.figure_format = 'retina'
```


Step 1: Antarctica Topography Simulation

Tree Construction Phase

Following the Jupyter Notebook instructions step by step to set up input parameters for TI tree onstruction

```
In [3]: # Read the training image
# these four parameter come from the user
Realization_Height = 1202 # the height of realization y-axid
Realization_Width = 1202 # the width of realization x-axix
knownUpbound = 3346 # the maximum value of elevation
knownBelowbound = -5000 # the minimum value of known elevation

Realization_row = np.loadtxt('z_Antarctica_python_realization.txt', skiprows=0)
# print('the size of realization is ' + str(Realization_row.shape))
Realization_2D = Realization_row.reshape(Realization_Height, Realization_Width)
plt.imshow(Realization_2D, cmap = 'jet', vmin=-7000, vmax=3000)
plt.title('Antarctica bed elevation map')
plt.colorbar()
```

Step 1: Antarctica Topography Simulation

Tree Construction Phase

Following the Jupyter Notebook instructions to set up input parameters for TI tree onstruction

```
In [2]: # artificially eliminate the ocean area on the top right corner
# the area whose elevation below this value is not trained
ArtificialThreshold = -1000

# set the radius of template the size of template is 2*radius+1
template_radius_x = 8
template_radius_y = 8

TreeHeight_max = 9

In [3]: # Read the training image
# these four parameter come from the user
Realization_Height = 1202 # the height of realization y-axis
Realization_Width = 1202 # the width of realization x-axis
knownUpbound = 3346 # the maximum value of elevation
knownBelowbound = -5000 # the minimum value of known elevation

Realization_row = np.loadtxt('Antarctica_python_realization.txt', skiprows=0)
```



Set parameters

- 1) The actual size of template is $2*radius+1$
- 2) The height h divides patterns into 2^h clusters
- 3) We do not concern the ocean area in this case

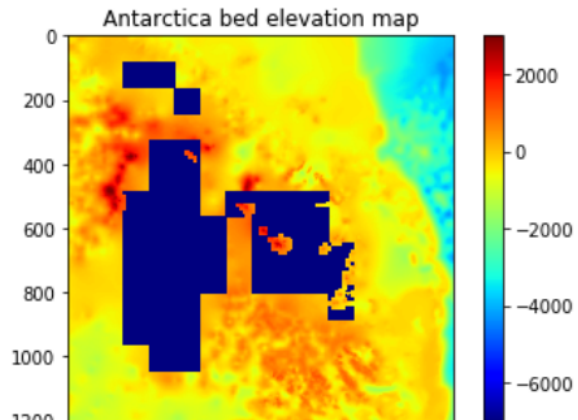
Step 1: Antarctica Topography Simulation

Tree Construction Phase

Following the Jupyter Notebook instruction to set up input parameters for TI tree onstruction

```
In [3]: # Read the training image
# these four parameter come from the user
Realization_Height = 1202 # the height of realization y-axid
Realization_Width = 1202 # the width of realization x-axix
knownUpbound = 3346 # the maximum value of elevation
knownBelowbound = -5000 # the minimum value of known elevation

Realization_row = np.loadtxt('z_Antarctica_python_realization.txt',skiprows=0)
# print('the size of realization is '+str(Realization_row.shape))
Realization_2D = Realization_row.reshape(Realization_Height,Realization_Width)
plt.imshow(Realization_2D,cmap = 'jet', vmin=-7000, vmax=3000)
plt.title('Antarctica bed elevation map')
plt.colorbar()
plt.show()
```



This cell is applied to read a txt file.

These values come from background knowledge.

Users can write their own function to read certain training images.

Step 1: Antarctica Topography Simulation

Tree Construction Phase

Once all the input parameters are set, simply run Step 3 command to construct the tree using TI.

4 Step 3. runing Training Phase to construct tree using training image

```
In [5]: build_TI_tree(project_name, TI, TI_row, Realization_Height, Realization_Width, ArtificalThreshold, \  
                template_radius_x, template_radius_y, TreeHeight_max, knownUpbound, knownBelowbound)
```

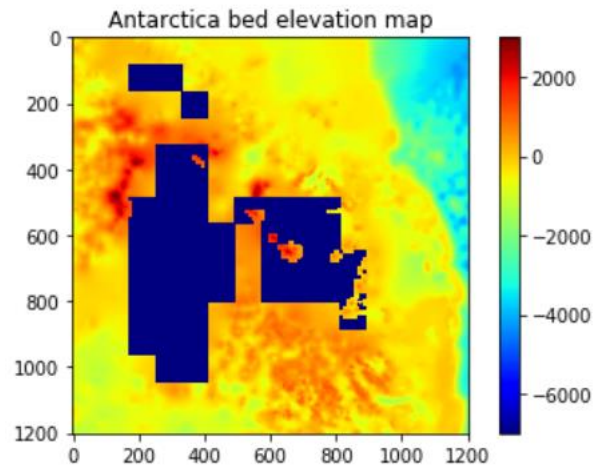
```
mission begins !  
2019-09-19 20:39:55  
The amount of pattern is 881351  
The size of pattern is 289  
running PCA  
The reduced dimension is 1
```

Step 1: Antarctica Topography Simulation

Tree Construction Phase

Input:

- 1) Training image



Output:

- 1) z_Antarctica_python_cluster_AverageDistance.txt
- 2) z_Antarctica_python_clusterTree_Representative_X.txt
- 3) z_Antarctica_python_clusterTree_Representative_Y.txt
- 4) z_Antarctica_python_clusterTree_Result.txt

User-defined parameters:

- 1) Template size
- 2) The height of tree
- 3) The land elevation threshold

z_Antarctica_python_cluster_AverageDistance.txt

z_Antarctica_python_clusterTree_Representative_X.txt

z_Antarctica_python_clusterTree_Representative_Y.txt

z_Antarctica_python_clusterTree_Result.txt

These four files are used to build the clustering tree.

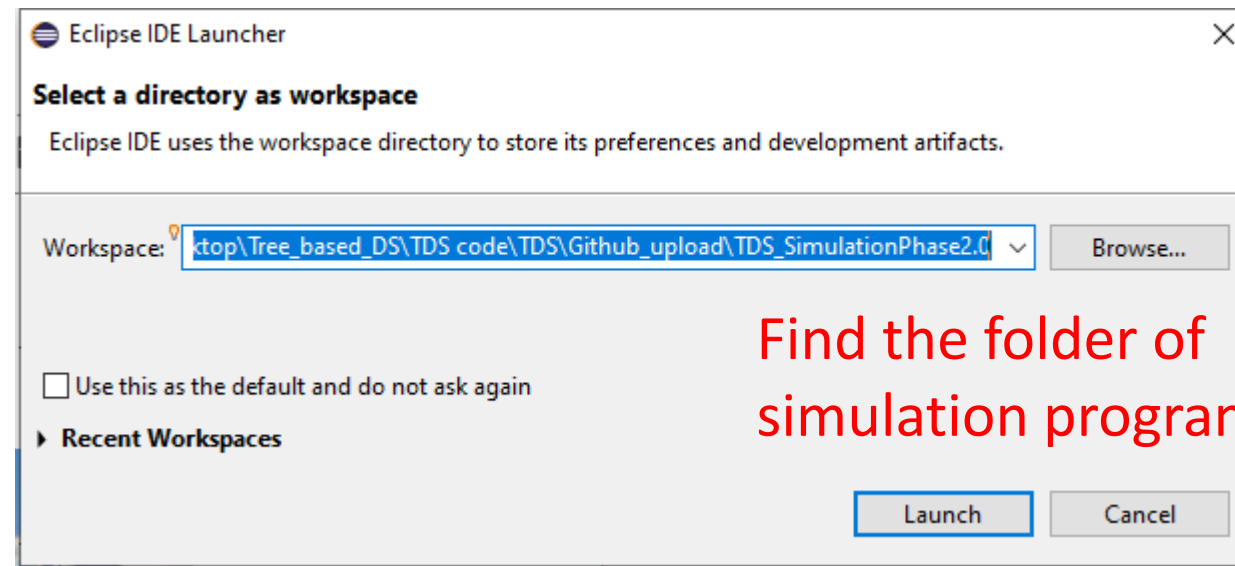
The training image is expressed
as txt file in this example

Step 2. Simulation Phase

Opening the Eclipse Java IDE, open the Simulation Phase under directory:
“./Tree-based_DS/TDS_SimulationPhase2.0”.



Icon of Eclipse Java

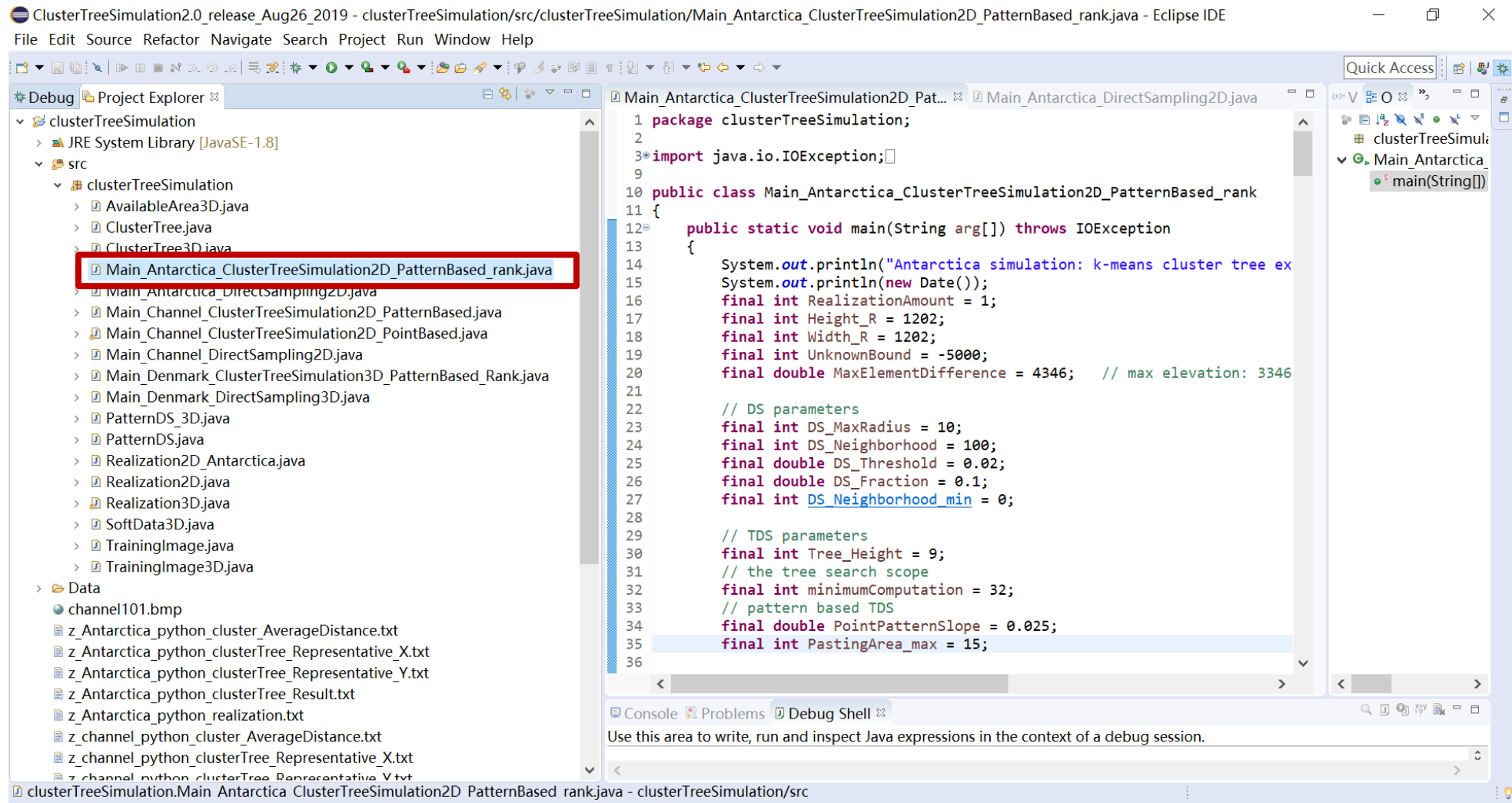


Launcher interface of Eclipse Java

Step 2: Antarctica Topography Simulation

Simulation Phase

The TDS simulation program is [Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank.java](#). This function is used to generate 2D Antarctica topography realizations using TDS



ClusterTreeSimulation2.0_release_Aug26_2019 - clusterTreeSimulation/src/clusterTreeSimulation/Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank.java - Eclipse IDE

File Edit Source Refactor Navigate Search Project Run Window Help

Debug Project Explorer

clusterTreeSimulation

- JRE System Library [JavaSE-1.8]
- src
 - clusterTreeSimulation
 - AvailableArea3D.java
 - ClusterTree.java
 - ClusterTree3D.java
 - Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank.java**
 - Main_Antarctica_DirectSampling2D.java
 - Main_Channel_ClusterTreeSimulation2D_PatternBased.java
 - Main_Channel_ClusterTreeSimulation2D_PointBased.java
 - Main_Channel_DirectSampling2D.java
 - Main_Denmark_ClusterTreeSimulation3D_PatternBased_Rank.java
 - Main_Denmark_DirectSampling3D.java
 - PatternDS_3D.java
 - PatternDS.java
 - Realization2D_Antarctica.java
 - Realization2D.java
 - Realization3D.java
 - SoftData3D.java
 - TrainingImage.java
 - TrainingImage3D.java
 - Data
 - channel101.bmp
 - z_Antarctica_python_cluster_AverageDistance.txt
 - z_Antarctica_python_clusterTree_Representative_X.txt
 - z_Antarctica_python_clusterTree_Representative_Y.txt
 - z_Antarctica_python_clusterTree_Result.txt
 - z_Antarctica_python_realization.txt
 - z_channel_python_cluster_AverageDistance.txt
 - z_channel_python_clusterTree_Representative_X.txt
 - z_channel_python_clusterTree_Representative_Y.txt

Main_Antarctica_ClusterTreeSimulation2D_Pat... Main_Antarctica_DirectSampling2D.java

```
1 package clusterTreeSimulation;
2
3 import java.io.IOException;
4
5
6
7
8
9
10 public class Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank
11 {
12     public static void main(String arg[]) throws IOException
13     {
14         System.out.println("Antarctica simulation: k-means cluster tree ex
15         System.out.println(new Date());
16         final int RealizationAmount = 1;
17         final int Height_R = 1202;
18         final int Width_R = 1202;
19         final int UnknownBound = -5000;
20         final double MaxElementDifference = 4346; // max elevation: 3346
21
22         // DS parameters
23         final int DS_MaxRadius = 10;
24         final int DS_Neighborhood = 100;
25         final double DS_Threshold = 0.02;
26         final double DS_Fraction = 0.1;
27         final int DS_Neighborhood_min = 0;
28
29         // TDS parameters
30         final int Tree_Height = 9;
31         // the tree search scope
32         final int minimumComputation = 32;
33         // pattern based TDS
34         final double PointPatternSlope = 0.025;
35         final int PastingArea_max = 15;
36     }
37 }
```

Quick Access

clusterTreeSimula

Main_Antarctica

main(String[])

Console Problems Debug Shell

Use this area to write, run and inspect Java expressions in the context of a debug session.

clusterTreeSimulation.Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank.java - clusterTreeSimulation/src

Step 2: Antarctica Topography Simulation

Simulation Phase

ClusterTreeSimulation2.0_release_Aug26_2019 - clusterTreeSimulation/src/clusterTreeSimulation/Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank.java - Eclipse IDE

File Edit Source Refactor Navigate Search Project Run Window Help

Debug Project Expl... Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank.java Main_Antarctica_DirectSampling2D.java

clusterTreeSimulation

- JRE System Library [Java]
- src
 - clusterTreeSimulation
 - AvailableArea3D.java
 - ClusterTree.java
 - ClusterTree3D.java
 - Main_Antarctica_C
 - Main_Antarctica_D
 - Main_Channel_Clus
 - Main_Channel_Clus
 - Main_Channel_Dire
 - Main_Denmark_Clu
 - Main_Denmark_Dir
 - PatternDS_3D.java
 - PatternDS.java
 - Realization2D_Ant
 - Realization2D.java
 - Realization3D.java
 - SoftData3D.java
 - TrainingImage.java
 - TrainingImage3D.j
 - Data
 - channel101.bmp
 - z_Antarctica_python_clu
 - z_Antarctica_python_clu
 - z_Antarctica_python_clu
 - z_Antarctica_python_rea
 - z channel python cluste

```
1 package clusterTreeSimulation;
2
3 import java.io.IOException;
4
5
6
7
8
9
10 public class Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank
11 {
12     public static void main(String arg[]) throws IOException
13     {
14         System.out.println("Antarctica simulation: k-means cluster tree with the search pattern-based rank-02");
15         System.out.println(new Date());
16         final int RealizationAmount = 1;
17         final int Height_R = 1202;
18         final int Width_R = 1202;
19         final int UnknownBound = -5000;
20         final double MaxElementDifference = 4346; // max elevation: 3346 min: -1398
21
22         // DS parameters
23         final int DS_MaxRadius = 10;
24         final int DS_Neighborhood = 100;
25         final double DS_Threshold = 0.02;
26         final double DS_Fraction = 0.1;
27         final int DS_Neighborhood_min = 0;
28
29         // TDS parameters
30         final int Tree_Height = 9;
31         // the tree search scope
32         final int minimumComputation = 32;
33         // pattern based TDS
34         final double PointPatternSlope = 0.025;
35         final int PastingArea_max = 15;
36     }
}
```

clusterTreeSimulation

- Main_Antarctica_ClusterTr
- main(String[]) : void

1) The number of realizations

2) Shape of realizations

3) The below bound threshold. The point whose value is lower than this threshold is view as an unknown point.

4) The difference is used to calculate the Euclidean distance in terms of continuous variable.

Use this area to write, run and inspect Java expressions in the context of a debug session.

clusterTreeSimulation.Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank.java - clusterTreeSimulation/src

Step 2: Antarctica Topography Simulation

Simulation Phase

ClusterTreeSimulation2.0_release_Aug26_2019 - clusterTreeSimulation/src/clusterTreeSimulation/Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank.java - Eclipse IDE

File Edit Source Refactor Navigate Search Project Run Window Help

Debug Project Expl... Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank.java Main_Antarctica_DirectSampling2D.java

clusterTreeSimulation

- JRE System Library [Java]
- src
 - clusterTreeSimulation
 - AvailableArea3D.java
 - ClusterTree.java
 - ClusterTree3D.java
 - Main_Antarctica_C
 - Main_Antarctica_D
 - Main_Channel_Clus
 - Main_Channel_Clus
 - Main_Channel_Dire
 - Main_Denmark_Clu
 - Main_Denmark_Dir
 - PatternDS_3D.java
 - PatternDS.java
 - Realization2D_Ant
 - Realization2D.java
 - Realization3D.java
 - SoftData3D.java
 - TrainingImage.java
 - TrainingImage3D.j
 - Data
 - channel101.bmp
 - z_Antarctica_python_clu
 - z_Antarctica_python_clu
 - z_Antarctica_python_clu
 - z_Antarctica_python_rea
 - z channel python cluste

```
1 package clusterTreeSimulation;
2
3 import java.io.IOException;
4
5
6
7
8
9
10 public class Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank
11 {
12     public static void main(String arg[]) throws IOException
13     {
14         System.out.println("Antarctica simulation: k-means cluster tree extra-search pattern-based rank-dri
15         System.out.println(new Date());
16         final int RealizationAmount = 1;
17         final int Height_R = 1202;
18         final int Width_R = 1202;
19         final int UnknownBound = -5000;
20         final double MaxElementDifference = 4346; // max elevation: 3346 min -1300
21
22         // DS parameters
23         final int DS_MaxRadius = 10;
24         final int DS_Neighborhood = 100;
25         final double DS_Threshold = 0.02;
26         final double DS_Fraction = 0.1;
27         final int DS_Neighborhood_min = 0;
28
29         // TDS parameters
30         final int Tree_Height = 9;
31         // the tree search scope
32         final int minimumComputation = 32;
33         // pattern based TDS
34         final double PointPatternSlope = 0.025;
35         final int PastingArea_max = 15;
36     }
}
```

clusterTreeSimulation

- Main_Antarctica_ClusterTr
 - main(String[]) : void

Fundamental setting about Direct Sampling

- 1) The radius to find conditioning data
- 2) The number of conditioning data
- 3) The distance threshold
- 4) The fraction of searching area
- 5) The minimum neighborhood indicate the minimum number of conditioning data.

Console Problems Debug Shell

Use this area to write, run and inspect Java expressions in the context of a debug session.

clusterTreeSimulation.Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank.java - clusterTreeSimulation/src

Step 2: Antarctica Topography Simulation

Simulation Phase

ClusterTreeSimulation2.0_release_Aug26_2019 - clusterTreeSimulation/src/clusterTreeSimulation/Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank.java - Eclipse IDE

File Edit Source Refactor Navigate Search Project Run Window Help

Debug Project Expl... Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank.java Main_Antarctica_DirectSampling2D.java

clusterTreeSimulation

- JRE System Library [Java]
- src
 - clusterTreeSimulation
 - AvailableArea3D.java
 - ClusterTree.java
 - ClusterTree3D.java
 - Main_Antarctica_C
 - Main_Antarctica_D
 - Main_Channel_Clus
 - Main_Channel_Clus
 - Main_Channel_Dire
 - Main_Denmark_Clu
 - Main_Denmark_Dir
 - PatternDS_3D.java
 - PatternDS.java
 - Realization2D_Ant
 - Realization2D.java
 - Realization3D.java
 - SoftData3D.java
 - TrainingImage.java
 - TrainingImage3D.j
 - Data
 - channel101.bmp
 - z_Antarctica_python_clu
 - z_Antarctica_python_clu
 - z_Antarctica_python_clu
 - z_Antarctica_python_clu
 - z_Antarctica_python_rea
 - z_channel python cluste

```
1 package clusterTreeSimulation;
2
3 import java.io.IOException;
4
5
6
7
8
9
10 public class Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank
11 {
12     public static void main(String arg[]) throws IOException
13     {
14         System.out.println("Antarctica simulation: k-means cluster tree extra-search pattern-based rank-dri
15         System.out.println(new Date());
16         final int RealizationAmount = 1;
17         final int Height_R = 1202;
18         final int Width_R = 1202;
19         final int UnknownBound = -5000;
20         final double MaxElementDifference = 4346; // max elevation: 3346 min -1300
21
22         // DS parameters
23         final int DS_MaxRadius = 10;
24         final int DS_Neighborhood = 100;
25         final double DS_Threshold = 0.02;
26         final double DS_Fraction = 0.1;
27         final int DS_Neighborhood_min = 0;
28
29         // TDS parameters
30         final int Tree_Height = 9;
31         // the tree search scope
32         final int minimumComputation = 32;
33         // pattern based TDS
34         final double PointPatternSlope = 0.025;
35         final int PastingArea_max = 15;
36     }
}
```

clusterTreeSimulation

- Main_Antarctica_ClusterTr
- main(String[]) : void

Console Problems Debug Shell

Use this area to write, run and inspect Java expressions in the context of a debug session.

clusterTreeSimulation.Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank.java - clusterTreeSimulation/src

Fundamental setting about Tree-based Direct Sampling

- 1) The height of tree (h in the manuscript)
- 2) The number of selected clusters (b in the manuscript)
- 3) The distance scalar (a in the manuscript)
- 4) The max size indicate the maximum size of pasting area.

Step 2: Antarctica Topography Simulation

Simulation Phase

ClusterTreeSimulation2.0_release_Aug26_2019 - clusterTreeSimulation/src/clusterTreeSimulation/Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank.java - Eclipse IDE

File Edit Source Refactor Navigate Search Project Run Window Help

Debug Project Expl...

clusterTreeSimulation

- JRE System Library [Java]
- src
 - clusterTreeSimulation
 - AvailableArea3D.java
 - ClusterTree.java
 - ClusterTree3D.java
 - Main_Antarctica_C
 - Main_Antarctica_D
 - Main_Channel_Clus
 - Main_Channel_Clus
 - Main_Channel_Dire
 - Main_Denmark_Clus
 - Main_Denmark_Dir
 - PatternDS_3D.java
 - PatternDS.java
 - Realization2D_Ant
 - Realization2D.java
 - Realization3D.java
 - SoftData3D.java
 - TrainingImage.java
 - TrainingImage3D.j
 - Data
 - channel101.bmp
 - z_Antarctica_python_clu
 - z_Antarctica_python_clu
 - z_Antarctica_python_clu
 - z_Antarctica_python_clu
 - z_Antarctica_python_rea
 - z_channel python cluste

Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank.java

```
36
37 // analyze the distance
38 double distance_print_primary_Mean = 0.00;
39 final int distance_print_Amount = 10000;
40 int simulationPointCounter = 0;
41 int searchCounter = 0;
42
43 Realization2D_Antarctica realization_Original = new Realization2D_Antarctica(Height_R,Width_R);
44 realization_Original.ReadRealizationFile(new String("z_Antarctica_python_realization.txt"));
45 //realization.PrintOut_Color(new String("z_original"));
46
47 int unknownAmount = realization_Original.GetUnknownAmount(UnknownBound);
48 System.out.println(new String("the number of unknown points is "+ unknownAmount));
49
50 Realization2D_Antarctica realization = new Realization2D_Antarctica(Height_R,Width_R);
51
52 final String affix = new String("z_Antarctica");
53 ClusterTree tree = new ClusterTree();
54 tree.ReadClusterTreeFile(affix);
55 tree.ReadClusterTreeLeafNodeFile(Tree_Height, Width_R, affix);
56
57 double[][] distanceImage = new double[Height_R][Width_R];
58
59 int realizationIndex=0,unknownIndex=0,unknownX=0,unknownY=0,unknownValue=0;
60 int currentHeight = 0,representativeX=0, representativeY=0, testClusterAmount=0;
61 int solutionX=0,solutionY=0,pasteSize_y=0,pasteSize_x=0,xx=0,yy=0;
62 int extraSearchAmount=0,extraSearchIndex=0,extraSearchScope=0,extraSearchRandom=0;
63 int extraSearch_ClusterIndex_Deviation = (1<<Tree_Height)-2;
64 double distance_min=0.0,distance=0.0,diversity=0.0;
65 Random random = new Random();
66 PatternDS pattern_DS = new PatternDS();
```

Main_Antarctica_DirectSampling2D.java

Quick Access

- clusterTreeSimulation
 - Main_Antarctica_ClusterTr
 - main(String[]) : void

Training image

Prefix of the clustering tree files

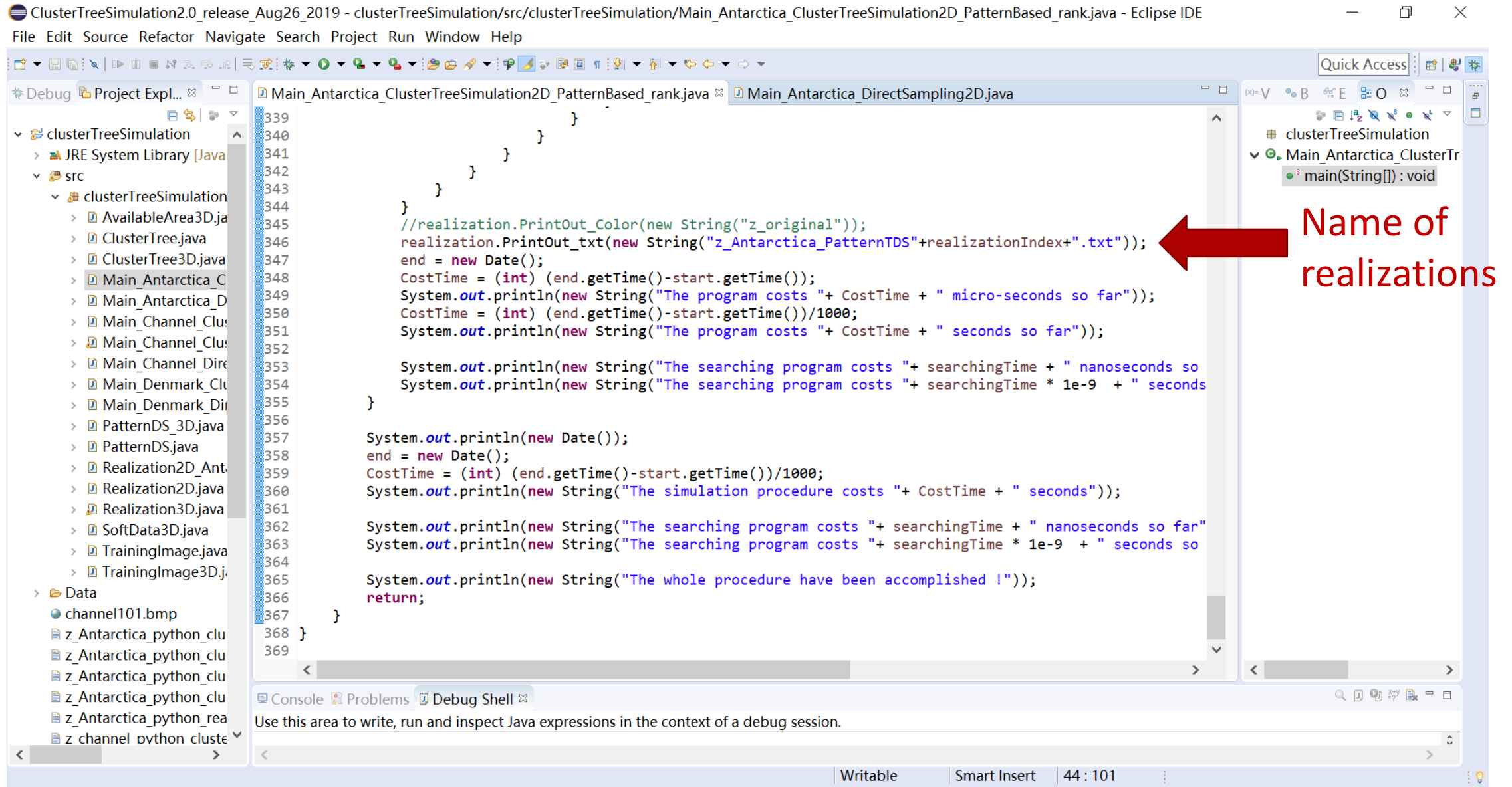
Console Problems Debug Shell

Use this area to write, run and inspect Java expressions in the context of a debug session.

Writable Smart Insert 44 : 101

Step 2: Antarctica Topography Simulation

Simulation Phase



Step 2: Antarctica Topography Simulation

Simulation Phase

ClusterTreeSimulation2.0_release_Aug26_2019 - clusterTreeSimulation/src/clusterTreeSimulation/Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank.java - Eclipse IDE

File Edit Source Refactor Navigate Search Project Run Window Help

Click the button to run the code

```
package clusterTreeSimulation;

import java.io.IOException;

public class Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank
{
    public static void main(String arg[]) throws IOException
    {
        System.out.println("Antarctica simulation: k-means cluster tree extra-search pattern-based rank-driven 2D mission begin !");
        System.out.println(new Date());
        final int RealizationAmount = 1;
        final int Height_R = 1202;
        final int Width_R = 1202;
        final int UnknownBound = -5000;
        final double MaxElementDifference = 4346; // max elevation: 3346 min -1300

        // DS parameters
    }
}
```

Debug Project Explorer

- clusterTreeSimulation
 - JRE System Library [JavaSE-1.8]
 - src
 - clusterTreeSimulation
 - AvailableArea3D.java
 - ClusterTree.java
 - ClusterTree3D.java
 - Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank.java
 - Main_Antarctica_DirectSampling2D.java
 - Main_Channel_ClusterTreeSimulation2D_PatternBased_rank.java
 - Main_Channel_ClusterTreeSimulation2D_PatternBased_rank3D.java
 - Main_Channel_DirectSampling2D.java
 - Main_Denmark_ClusterTreeSimulation3D_PatternBased_rank.java
 - Main_Denmark_DirectSampling3D.java
 - PatternDS_3D.java
 - PatternDS.java
 - Realization2D_Antarctica.java
 - Realization2D.java
 - Realization3D.java
 - SoftData3D.java
 - TrainingImage.java
 - TrainingImage3D.java
 - Data
 - channel101.bmp
 - z_Antarctica_python_cluster_AverageDistance.txt
 - z_Antarctica_python_clusterTree_Representative_X.txt
 - z_Antarctica_python_clusterTree_Representative_Y.txt
 - z_Antarctica_python_clusterTree_Result.txt
 - z_Antarctica_python_realization.txt
 - z_channel_python_cluster_AverageDistance.txt
 - z_channel_python_clusterTree_Representative_X.txt
 - z_channel_python_clusterTree_Representative_Y.txt

Quick Access

- clusterTreeSimulation
 - Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank
 - main(String[]) : void

Console Problems Debug Shell

Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank [Java Application] C:\Program Files\Java\jre1.8.0_221\bin\javaw.exe (2019年8月29日 下午4:00:01)

Antarctica simulation: k-means cluster tree extra-search pattern-based rank-driven 2D mission begin !

Thu Aug 29 16:00:01 PDT 2019

load the realization

the number of unknown points is 280185

Read all cluster representatives

Read all cluster member patterns

2D simulations begin !

Thu Aug 29 16:00:06 PDT 2019

realization0

Writable Smart Insert 108 : 31

21

Step 2: Antarctica Topography Simulation

Simulation Phase

ClusterTreeSimulation2.0_release_Aug26_2019 - clusterTreeSimulation/src/clusterTreeSimulation/Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank.java - Eclipse IDE

File Edit Source Refactor Navigate Search Project Run Window Help

Debug Project Explorer

clusterTreeSimulation

- JRE System Library [JavaSE-1.8]
- src
 - clusterTreeSimulation
 - AvailableArea3D.java
 - ClusterTree.java
 - ClusterTree3D.java
 - Main_Antarctica_ClusterTreeSimulation2D_P
 - Main_Antarctica_DirectSampling2D.java
 - Main_Channel_ClusterTreeSimulation2D_Pat
 - Main_Channel_ClusterTreeSimulation2D_Poi
 - Main_Channel_DirectSampling2D.java
 - Main_Denmark_ClusterTreeSimulation3D_Pa
 - Main_Denmark_DirectSampling3D.java
 - PatternDS_3D.java
 - PatternDS.java
 - Realization2D_Antarctica.java
 - Realization2D.java
 - Realization3D.java
 - SoftData3D.java
 - TrainingImage.java
 - TrainingImage3D.java
 - Data
 - channel101.bmp
 - z_Antarctica_python_cluster_AverageDistance.txt
 - z_Antarctica_python_clusterTree_Representative_X
 - z_Antarctica_python_clusterTree_Representative_Y
 - z_Antarctica_python_clusterTree_Result.txt
 - z_Antarctica_python_realization.txt
 - z_channel_python_cluster_AverageDistance.txt
 - z_channel_python_clusterTree_Representative_X tv

Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank.java

```
1 package clusterTreeSimulation;
2
3 import java.io.IOException;
4
5
6
7
8
9
10 public class Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank
11 {
12     public static void main(String arg[]) throws IOException
13     {
14         System.out.println("Antarctica simulation: k-means cluster tree extra-search pattern");
15         System.out.println(new Date());
16         final int RealizationAmount = 1;
17         final int Height_R = 1202;
18         final int Width_R = 1202;
19         final int UnknownBound = -5000;
20         final double MaxElementDifference = 4346; // max elevation: 3346 min -1300
21
22         // DO something
23     }
24 }
```

Main_Antarctica_DirectSampling2D.java

Quick Access

- clusterTreeSimulatic
- Main_Antarctica_Cl
- main(String[]) : vc

Console Problems Debug Shell

<terminated> Main_Antarctica_ClusterTreeSimulation2D_PatternBased_rank [Java Application] C:\Program Files\Java\jre1.8.0_221\bin\javaw.exe (2019年8月)

```
Read all cluster representatives
Read all cluster member patterns
2D simulations begin !
Thu Aug 29 16:00:06 PDT 2019
realization0
The program costs 500335 micro-seconds so far
The program costs 500 seconds so far
The searching program costs 147460999993 nanoseconds so far
The searching program costs 147.460999993 seconds so far
Thu Aug 29 16:08:26 PDT 2019
The simulation procedure costs 500 seconds
The searching program costs 147460999993 nanoseconds so far
The searching program costs 147.460999993 seconds so far
The whole procedure have been accomplished !
```

The program outputs the running time in the console.

22

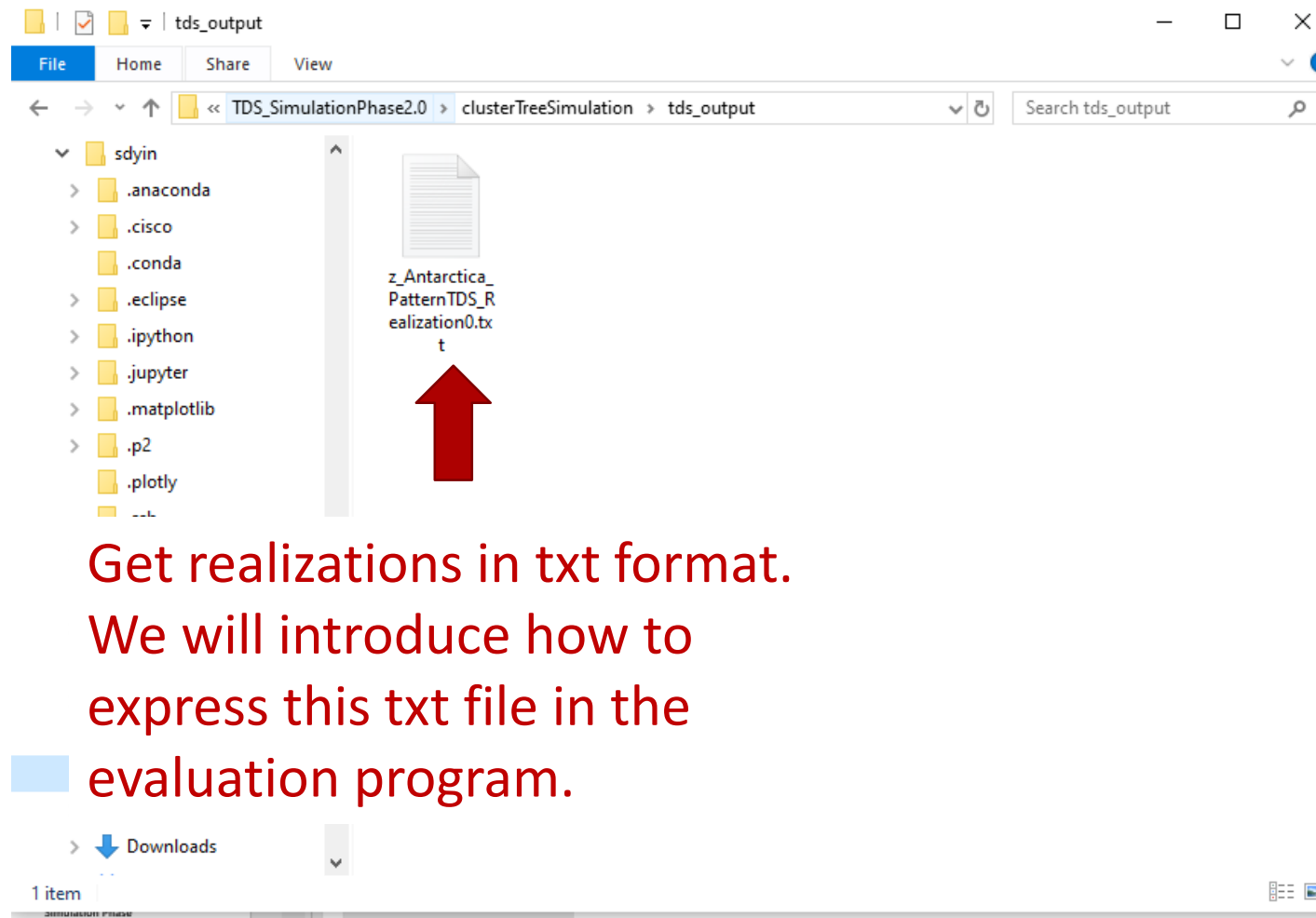
Writable Smart Insert 108 : 31

Step 2: Antarctica Topography Simulation Simulation Phase

Results:

The TDS simulated realizations will be stored at directory:

“/Tree-based_DS/TDS_SimulationPhase2.0/clusterTreeSimulation/tds_output”



Get realizations in txt format.

We will introduce how to
express this txt file in the

evaluation program.